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September 2005

Abstract

Since the late 1990s when massive backlash against genetically modified crops and food emerged worldwide, the mainstream political economic powers, so to say, the US government and transnational biotech companies, have been actively and deliberately engaged in the discourse of "biotechnology for the poor to combat the world hunger". This line of discourse has been endorsed on several occasions of international gatherings as well as in epistemic community. The objective of this paper is to sort out and analyse critically the discourse put forward by the mainstreamers. Within the hegemonic ideological, political, and legal setting of biotechnology development, we have to look for the room for manoeuvre so that we can carefully make out alternative perspectives and frameworks to go beyond the never-ending pro-contra debate and then to re-appropriate and re-design biotechnology to fit in the socio-economic and bio-environmental context of the resource poor in the developing world. In order for this process to be theoretically reflected, we will refer to Gramsci's concept of hegemony and counter-hegemony, as well as Feenberg's concept of democratic rationalisation.

Keywords: discourse, biotechnology, resource poor farmers, counter hegemony, transformative education
NB: This paper is a draft to be edited and submitted to the journal of *Tailoring Biotechnologies*.

1. Increasing discourse of "biotechnology for the poor"

Since the late 1990s when massive backlash against GMOs emerged worldwide, the mainstream political economic powers, so to say, the US government and transnational biotech companies, have been actively and deliberately engaged in the discourse of "biotechnology for the poor to combat the world hunger". This line of discourse has been endorsed on several occasions of international gatherings, not least at the international conference on biotechnology convened by the Consultative Group on International Agricultural Research (CGIAR) and the US National Academy of Sciences and co-sponsored by UN agencies (e.g. FAO, UNDP, UNEP, UNIDO, and UNESCO) in October 1999. The proceeding of this conference was then published with the title of 'Agricultural Biotechnology and the Poor' (Persley and Lantin eds. 1999). While heated debate on the technology still remains in the realm of food and environmental safety of GMOs, the discourse of "biotechnology for the poor" has been consistently pushed ahead and gradually penetrated into the international community by the mainstreamers.

> *The topic of global hunger has become a prominent backdrop for the worldwide debate over genetically modified food crops. The possible use of biotechnology to boost food production and quality in developing countries has become a focal point for biotechnology advocates and critics alike. (Pew Initiative 2004)*

It was under such a circumstance that the UN Development Programme (UNDP) released the controversial "Human Development Report 2001" (UNDP 2001). This report subtitled 'Making new technologies work for human development' is focused on "the way that biotechnology and information and communications technology can transform lives in developing countries". The report clearly says that many developing countries might reap great benefits from GMOs. While it acknowledges that there are environmental and health risks that need to be addressed (Fukuda-Parr 2001), it stresses the unique potential of the technology, urging far greater public investment in research and development to ensure that biotechnology meets the agricultural needs of the world's poor. As was to be expected under ongoing pro-contra conflicts over the technology, this report generated strong reactions from a number of NGOs (e.g. PAN-AP 2001) as well as from prominent critics (e.g. Shiva 2001). On the other side of the conflicted views, this report was welcomed as a "timely and constructive review of the potential for biotechnology to help some of the world's poorest communities" (Monsanto 2001).

The discourse of "biotechnology for the poor" as well as the resulting pro-contra debate about it was renewed in May 2004, when the UN Food and Agriculture Organisation (FAO) launched its annual report of 'the State of Food and Agriculture 2003/04' featuring its focus on "the potential for agricultural biotechnology to address the needs of the world's poor and food-insecure" (FAO 2004). FAO's answer to the question of "whether agricultural biotechnology can meet the needs of the poor" is largely affirmative, although it also points out that the "gene revolution" is not panacea and needs to be approached cautiously. As shown in an open letter to Director-General of FAO signed by more than 650 civil society organisations and 800 individuals (ETC Group 2004), the FAO is now strongly criticised for marking a radical departure from its cautious approach to the technology[1]. On the other side

[1] Indeed, the FAO has always claimed that we need to pay more attention to diverse forms of biotechnology, such as molecular

of the pro-contra debate, again, this report receives a big welcome. While some incompatibilities with vested interests of the mainstreamers can be perceived in the way the FAO is being committed to the technology, it is certain that the FAO doesn't give right answers to the question of what technology should/can be developed in what way and in whose hands. Therefore, it is still relevant to ask the same question whether and how it is possible to develop feasible biotechnologies which address the real problems of the resource poor.

What we need to do now is not to throw the baby out with the bath water, but to carefully evaluate the discourse of "biotechnology for the poor" and disentangle and salvage positive messages out of the discourse. This framing of the issue is pressing, otherwise even concerned scientists and administrators, as well as those who have more moderate and nuanced stance, would find it difficult to keep their position away from the influence manoeuvred by the mainstreamers, for the discourse of "biotechnology for the poor" is somewhat convincing, at least ostensibly, given the fact that an additional 2 billion people will have to be fed over the next 30 years from an increasingly fragile natural resource base and that more than 800 million people are chronically hungry (FAO 2004).

The objective of this paper is to sort out and analyse critically the discourse put forward, as well as what has been actually pursued, by the mainstreamers. This analysis is meant to understand the ideological background, against which we have to carefully make out alternative perspectives and frameworks to re-appropriate and re-design biotechnology to fit in the socio-economic and bio-environmental context of the resource-poor in the developing world as Tailor-made Biotechnologies Network (TMBT) Project is aimed to do so (Ruivenkamp 2003b) [2]. In this regard, we deadly need to look for the room for manoeuvre within the hegemonic political, economic, and legal setting of biotechnology development. Otherwise ambitious endeavours for alternatives such as TMBT might be going down to another fragmented niche project as seen everywhere in the local. Because of a lack of space, however, this paper won't look at international legal and political frameworks that are considered critical to redirect the path of biotechnology development, such as intellectual property right (IPR) regime and biosafety regulation. Instead, I'd rather focus on the mainstream discourse: how it has been (re)produced and in turn has structured the course of biotechnology development. To do so, I will draw upon Antonio Gramsci's concept of hegemony, since it enables us to grasp the nature of ideology in contemporary capitalist societies in which ideological factors are of great importance in affecting social and political relations by reproducing and legitimising a particular set of interests as a common view or general interests (Gramsci 1971). Additionally, out of this concept we can understand the possibilities, or room for manoeuvre, to challenge the hegemony: counter-hegemony, which is not just meant to work against the dominant cultural assumptions, but rather to work for the creation of new social relations. In addition to Gramsci's concept, by referring to Andrew Feenberg's concept of democratic rationalisation (Feenberg 1999), I'd like to open a theoretical window through which the concept of TMBT can be developed further.

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marker assisted selection, tissue culture technique, and other feasible biotechnologies. This line of discussion is especially pushed ahead by Louise O. Fresco, Deputy Director-General of FAO (Fresco 2003).

[2] The idea and activities of the TMBT project is also outlined in the first issue of this journal (Ruivenkamp 2005).

2. The way and context in which mainstreamers put forward the discourse

As mentioned earlier, proponents of GM technology claim that GM crops will feed the world by increasing agricultural yields and overcome malnutrition by developing 'functional foods' such as pro-vitamin A enhanced rice (dubbed 'Golden Rice'). Millions are being spent on advertising and PR campaigns across the world to persuade consumers and policy makers to accept GM crops. The most outstanding example of PR campaigns counting on the discourse of "biotechnology for the poor" was aggressively but tactically launched by Monsanto Europe in the summer of 1998 in the light of rapidly growing criticism and scepticism against GM technology among European citizens. Entitled 'Let the Harvest Begin' and signed by some 50 prominent scientists and policy makers from developing countries, its message says in a ringing voice that:

> *As we stand on the edge of a new millennium, we dream of a tomorrow without hunger. To achieve that dream, we must overcome many hurdles, including poverty, distribution, water supply, soil erosion and crop disease. Biotechnology alone cannot address all of these hurdles, but it is an important tool in our hands today. We know advances in biotechnology must be tested and safe, but they should not be unduly delayed.*

This advertising message was swiftly responded and criticised by the African delegates to the FAO's Commission on Genetic Resources. The counter-statement, entitled 'Let Nature's Harvest Continue', strongly objects "the image of the poor and hungry from our countries is being used by giant multinational corporations to push a technology that is neither safe, environmentally friendly, nor economically beneficial to us." (cited in Paul & Steinbrecher 2003).

Nevertheless, similar PR messages have been overwhelmingly circulated and repeatedly appeared in media, mainstream scientific and popular journals, policy documents and the like around the world. Seven Academies of Science led by the US National Academy of Science, for example, urged action to promote the use of GM technology in alleviating world hunger and poverty (Seven Academies of Science 2000). These claims made by the mainstreamers in favour of GM crops are so compelling that we are almost led to believe that only "ideological or pseudo-scientific reasons" can be given for opposing their acceptance and holding up research into "potential solutions" and that we could be blamed of being "irresponsible and immoral" (Prakash 1999).

> *The application of genetic modification to crops has the potential to bring about significant benefits…. The moral imperative for making GM crops readily and economically available to developing countries who want them is compelling. (Nuffield Council on Bioethics 1999)*

> *There is an ethical obligation to explore these potential benefits responsibly, in order to improve food security, economically valuable agriculture and the protection of the environment in developing countries. (Nuffield Council on Bioethics 2003)*

But, it cannot be presumed if and how highly sophisticated, patented, and expensive tools and technologies can be applied to even more diversified, complex and marginalised conditions of many localities. Also, when we look at a variety of alternative approaches available to address the problems resource-poor farmers in the

developing world are facing, we can raise a legitimate question about the potentiality and feasibility of biotechnology to feed the hungry. That's why the discourse, however accompanied by an ethical point of view, should be the subject of inquiry as this paper is aimed.

Reality of "Molecular Divide"

There exists "a sharp dichotomy between developed and developing countries" in terms of agricultural biotechnology research expenditures (FAO 2004). It is roughly estimated that the crop biotechnology research and development (R&D) in developed countries including both of public and private sectors amounts to $1,900-2,500 million a year, while only $165-250 million is spent in developing countries (Byerlee and Fischer 2002). More noteworthy is the fact that a handful of transnational biotech companies influence agricultural biotechnology R&D. For example, Monsanto invested $527 million in R&D (2002), more than 80 percent of which was directed to the seed business. Syngenta spent $727 million to R&D in 2003, out of which $127 million and $146 million was spent to the seed development and plant science research respectively. DuPont's total amount of R&D expenditure reached $1,349 million in 2003, 43 percent of which was directed to agricultural science. The magnitude of private-sector investment in agricultural biotechnology R&D is more tremendous than these amounts would suggest, given that the CGIAR, which is the largest international public-sector supplier of agricultural technologies, has a total annual budget of less than $300 million for plant improvement R&D, including around $25 million for biotechnology R&D, in developing countries (FAO 2004).

The private-sector biotechnology R&D has been largely dedicated to developing GM crops and traits that are of significance to the commercial market in agricultural exporting countries whether developed or developing (i.e. the US, Argentina, Canada, Brazil) with the exception of China. It is estimated that the most widely grown GM crops are soybean (61.2%), maize (22.9%), cotton (10.6%), and canola (5.3%) with either trait of herbicide tolerance (73.4%) or insect resistance (18.0%) or both (8.6%) (James 2004). Almost all of them are developed and distributed directly or indirectly by a handful of biotech companies (i.e. Monsanto, Syngenta, DuPont, Bayer, and Dow AgroSciences).

Furthermore, it is worth noting that, other than biotechnology products, the means of biotechnology R&D are also controlled by those same companies. A survey conducted by a team of University of California researchers shows that the private sector holds 74 percent of agricultural biotechnology patents, with 41 percent of them owned by the big five (Graff et al. 2003). It is also mentioned that many of the fundamental methods for transferring genes into plant cells, including the use of *Agrobacterium*, were invested in the public sector, but the rights to those technologies have, to a large extent, been licensed exclusively to private companies, who in turn have concentrated their patenting on application-based technologies for established product lines. This kind of technology transfer between the public and private sectors is being promoted especially in the US and some other developed countries, where federal (or national) legislations to change research financing and patent policies have opened new opportunities for "public-private collaboration" (Fuglie and Schimmelpfenning 2000).

Attention to the role of public-sector R&D

When it comes back to the discourse of "biotechnology for the poor", the private-sector's interests are not paid on public-good research (e.g. crop improvements) of relevance to small-scale farmers and to complex tropical and subtropical environments. Such public-good research is also understated by the poorly-financed public-sector organisations working in developing countries (i.e. CGIAR centres and national agricultural research institutes), whether or not they are institutionally biased to do so. This gap has long been recognised among the international community including the World Bank and the FAO as well as the academic community.

> *Little attention will be paid to crops of importance in the developing world or to the pests, diseases, and stresses that afflict them unless the crops are also important to the more advanced countries. (World Bank 1997: 15)*

> *…the strategic application, in sharp contrast to the "Green Revolution," takes place largely in the private sector where much of the intellectual property is controlled. In these circumstances, research priorities are driven by market forces. Companies produce products whose costs are recoverable in the marketplace… (Seven Academies of Science 2000: 23)*

> *Agricultural public goods, including crops and traits of importance to subsistence farmers in marginal production environments, are of little interest to large transnational companies. (FAO 2004: 38)*

Now that the private-sector's lack of interests in the needs of the poor is undeniably acknowledged, what is required to legitimise the mainstreamers' discourse is to incorporate more nuanced meanings of GM technology as not being "silver bullet" nor "technological quick-fix". Besides, growing attention is paid to the critical role of "honest brokers" such as FAO, CGIAR and other multilateral organisations aiming for pro-poor technologies while addressing public concerns about potential risks of GMOs on human health and the environment. For example, Seven Academies of Science recommends governments, international organisations and aid agencies to increase public funding for public-good research in both CGIAR and national research institutions (Ibid.: 24). Indeed, expectations for the role that CGIAR centres and national agricultural research system (NARS) in developing countries can and should play have been commonly expressed in a various way (Persley and Lantin 1999; Nuffield Council on Ethics 1999; Pinstrup-Andersen and Cohen 2000; FAO 2004).

While we often come across optimistic views on the role of international and national institutions to "provide resources aimed at developing and distributing GM crops in developing countries and helping these countries build scientific and legal capacity to properly manage crop development, risk management, and intellectual property management" (Pew Initiative 2004: 27), however, the reality doesn't seem to be like that. During the 1990s, the growth rate of public expenditure on agricultural research slowed dramatically in many developing countries (Pardey and Beintema 2001). Also, international donor and aid agencies no longer give agriculture, and with it agricultural R&D, the attention they once did (ibid.)[3]. As a result, funding for CGIAR centres has stagnated in real terms (World Bank 2003). This has strengthened the gap between public and private research, between research priorities and needs, between developing and developed countries, between poor and rich farmers; that is, a "molecular divide" as Fresco (2003) clearly describes.

[3] This situation has been brought about under liberalisation, structural adjustment programmes, privatisation and economic globalisatoin policies. It is ironic that the same political economic powers who have propelled such policies are now advocating the increase of funding for national and international public research.

Against these trends, it is quite logical that the same line of documents suggests that: “the challenge is: how to bridge the gap between the interests of the public and private sectors and redefine their roles” (Persley 1999: 17).

> *For this reason public research must be strengthened... CGIAR, with its focus on the needs of the developing countries, has to continue to play a conspicuous role in such an effort – and international financial support for the CGIAR therefore ought to remain high. But there must also be more and more intensive cooperation between the private and public sectors. (Leisinger 1999)*

3. Public-private partnerships for technology transfer: beyond the discourse

Public-private collaboration is generally expected to bridge the gap in biotechnology R&D by facilitating the transfer of technology and expertise from developed countries to developing ones (Kameri-Mbote et al. 2001). While relationships between universities and industries, between public research institutions and private companies, have existed in developed countries for a certain period, it is still an unproven challenge to bring relevant actors into public-private partnerships for biotechnology in developing countries.

Byerlee and Fischer (2002) analyse the relevance of four broad options for public policy: (i) leave technology transfer entirely in the hands of the private sector; (ii) develop a public programme independently of the private sector; (iii) negotiate to access relevant proprietary technologies through a range of commercial and non-commercial arrangements such as material transfer and licensing agreements and market segmentation; and (iv) negotiate public-private alliances and joint ventures to develop appropriate technologies. More simply, Pingali and Traxler (2002) consider the two possibilities of: (v) choosing to concentrate its research resources in areas that the private sector is not engaged; and (vi) seeking collaboration and partnership with the private sector. Here, options (iii), (iv) and (vi) fall into the concept of public-private partnerships and, given a lack of resources and capacities on the side of the public sector, are likely to be chosen as an effective measure for each sector to contribute to solving problems in developing countries.

> *It is clear… that the public sector will have to play a key role in biotechnology R&D in developing countries, but that the public sector working alone will make slow progress. Thus public-private partnerships will be a central element of any R&D strategy. (Byerlee and Fischer 2002: 938)*

> *The incentives for private sector investment in the more marginal, subsistence oriented production systems are limited… Only through effective public/private partnerships will these technologies reach marginal producers and orphan crops. (Pingali and Traxler 2002: 237)*

> *Potentially, public-private partnerships represent a more effective means of addressing large and complex research problems in developing country agriculture because they combine intellectual resources with human capital, financial resources, institutional support, and complementary, synergetic potential. (Spielman and van Grebmer 2004: 36)*

To this end, however, governments and public sector organisations in developing countries need to put in

place a wide array of institutional arrangements such as: enactment and enforcement of "more efficient" biosafety regulations and "stronger" intellectual property rights as stipulated and recommended by multilateral organisations (i.e. OECD, Codex, WIPO, UPOV, etc.); provision of sound infrastructure, services and incentives (e.g. tax incentives for equipment acquisition, import and investment); efficient markets for agricultural technologies (e.g. liberalisation of government monopoly); and so on (Kameri-Mbote et al. 2001; FAO 2004)[4]. This is because existing institutional settings are believed to impede private investments necessary for the international transfer of biotechnology innovations (FAO 2004). Kameri-Mbote and her colleagues go on to say that: "Developing countries should depart from the tradition of viewing the private sector as being made up of profit propelled establishments. The sector should be viewed and acknowledged as a utility player in biotechnology research and development" (Kameri-Mbote et al. 2001: 24). Before giving careful consideration to such a political implication, I'm going to give some examples of public-private partnerships in biotechnology for the poor already implemented in developing countries.

CGIAR

In 1995, the CGIAR established and convened committees of the private sector (Private Sector Committee: PSC) and the civil society (NGO Committee: NGOC) as a means of improving the dialogue among stakeholders. This was a part of the process toward the Third System Review of CGIAR (1998). Despite all the effort of the NGOC to incorporate its alternative viewpoints, the review report largely followed the proposal of the PSC and called for intensified commitment to biotechnology (genetic engineering) R&D and intellectual property rights (IPR), and greater partnership with the private sector (CGIAR 1998; GRAIN 1998; German NGO Forum 1999). Even before the review process were some collaboration already launched, including those between the CIAT (International Centre for Tropical Agriculture, Columbia) and Novartis (now Syngenta) on the use of the latter's proprietary technology for use in cassava by the former; between the IRRI (International Rice Research Institute, the Philippines) and Plantech (Mitsubishi Chemical) and Novartis (now Syngenta) on the use of Bt genes in rice; and between the CIP (International Potato Centre, Peru) and Plant Genetic Systems (owned by AgrEvo, now Bayer CropScience), AXIS Genetics (UK) and Monsanto separately on the use of Bt genes and technologies in potatoes and sweet potatoes.

In these cases, the proprietary genes and technologies have been provided free of charge. Also, the products, if successfully developed, could be available in segmented markets at a cheap price or free of charge. Theoretically, this kind of technology transfer could allow proprietary technologies to be applied to typical subsistence crops of significance to resource-poor farmers and made available among them. However, few technologies for such crops have been successfully developed and transferred so far.

Furthermore, the case of "Golden Rice" project, in which 71 patented technologies owned by 32 different companies and universities are involved (Potrykus 2000), shows a difficulty to deal with IPR and biosafety issues, as

[4] It might be instructive to remind here that, under the ever-increasing pressure of neo-liberal globalisation, this kind of institutional arrangements to keep or attract private investments (mainly those of transnational companies) is also expected from governments and public sector even in developed countries, as termed 'national competitive state' by Hirsch (1995).

well as a technical difficulty to achieve the level enough to put into practical use. Although the Golden Rice Humanitarian Board, established in 2000, has been working on negotiation to make the rice freely available to national and international agricultural research centres, whether Golden Rice provides either the most effective or the most desirable solution to vitamin A deficiency (VAD) problem is open to question. For example, this project has been criticised on the ground that we already know low-risk and low-cost solutions such as encouraging farmers to go back to growing indigenous, familiar vitamin A-rich plants among main crops, a practice wiped out by 'Green Revolution' (MASIPAG 2000).

Another worrisome is how genetic and other resources hold and managed by CGIAR centres will be used and, in a literal sense, capitalised on through their partnerships with the private sector. A recent case of public-private partnership involving the ICRISAT (International Crops Research Institute for the Semi-Arid Tropics, India) shows that a key motivation for CGIAR centres to move into partnerships with the private sector is their lack of money (GRAIN 2004). In exchange for providing financial resources and proprietary technologies, private partners can access to the resources the centres have, namely, the vast genetic resources (in the case of the ICRISAT, currently 114,000 land races and varieties of sorghum, millet, groundnut, chickpea, and pigeonpea taken from more than 100 countries), researchers, facilities as well as test fields. While the ICRISAT case is using those typical "orphan" crops, the private partners (including subsidiaries or joint-companies of Advanta, Monsanto, Bayer and Syngenta) are given five years of exclusive access to ICRISAT's resources before available to others.

ISAAA

In order to support the search for collaboration possibilities, several brokering institutions have been established. Among others, the International Service for the Acquisition of Agri-biotech Applications (ISAAA), since its establishment in 1991, has played a crucial role in "the transfer and delivery of appropriate biotechnology applications to developing countries and the building of partnerships between institutions in the South and the private sector in the North, and by strengthening South-South collaboration" (ISAAA 2002). ISAAA-brokered projects are well documented in Alvarez (2000).

The case of CINVESTAV (Centre of Research and Advanced Studies, Mexico) and Monsanto collaboration on the virus-resistant potato project is critically analysed by Commandeur (1996) and Qaim (1998). Ironically, potatoes are predominantly grown by large and medium-scale farmers in Mexico. Even for small farmers that do grow potatoes, the technology donated by Monsanto in 1991 didn't make sense because it was expected to cope with two kinds of potato viruses (PVX and PVY) that are not the most pressing problems there. Another transfer was done, in 1997, for a gene of resistance to a potato virus (PLRV), which too is of relatively minor importance when compared with leaf blight (gaining resistance to this Phytophthora is difficult to achieve due to its less-understood multigenic function) and other structural problems. Additionally, a lack of mechanism for new varieties to reach small-scale farmers, such as a formal seed market to ensure regular renewal of certified seed potatoes and public technological assistant programmes (i.e. extension services), is also pointed out.

The case of KARI (Kenyan Agricultural Research Institute, Kenya) and Monsanto collaboration on the

virus-resistant sweet potato project has been held up worldwide as an example of how GM crops will help revolutionise farming in Africa. However, as of 2004, three years of field trials have shown that GM sweet potatoes modified to resist a virus were no less vulnerable than ordinary varieties, and sometimes their yield was lower. The GM project has cost Monsanto, the World Bank and the US government an estimated $6 million over the past decade. In his research on GM crops in Sub-Saharan Africa (DeGrassi 2003), deGrassi concluded that: "Virus-resistant sweet potatoes are not demand driven, site specific, poverty focused, cost effective, and institutionally and environmentally sustainable". Embarrassingly, in Uganda conventional breeding has produced a new, high-yielding virus-resistant variety of sweet potato in just a few years and at a small cost (Ibid.).

Although the ISAAA describes its activities as "a demand-driven program that responds to the priority needs of target national programs in Africa, Asia and Latin America", the strategy is rather to focus on the introduction of near-term biotechnology applications that already have been tested in developed countries (ISAAA 2002). Its programmes are also directed at promoting public acceptance of the technology through publications, seminars, workshops, and most importantly its fellowship programmes. According to its critics, the fellowship programmes are intended to build up an advocacy elite network "to create the regulatory environment for the successful introduction of corporate biotechnology from the North" (GRAIN 2000).

USAID

The US Agency for International Development (USAID) is another important broker. In 1990 the USAID introduced a new programme designed to integrate management and technology transfer issues with biotechnology R&D and training (Lewis 1999). Since then the USAID has directly supported several public-private sector collaborative research programmes, mainly through the Agricultural Biotechnology Support Program (ABSP) managed by Michigan State University (1991~2003) and Cornell University (2003~). ABSP's projects have been largely focused on institutional capacity-building for the use and management of biotechnology R&D (i.e. intellectual property rights and biosafety regulation).

The public-private partnerships which USAID/ABSP have supported include the Bt maize project involving CRIFC (Central Research Institute for Food Crops, Indonesia), Zeneca Plant Science (now Syngenta) and ICI Seeds (now Advanta); the virus-resistant melon project involving CIBCM (Centre for Research in Cellular and Molecular Biology, Costa Rica) and Asgrow Seeds (now ELM/Seminis); the Bt maize project involving AGERI (Agricultural Genetic Engineering Research Institute, Egypt); and the virus-resistant sweet potato project, co-sponsored by the ISAAA, involving KARI and Monsanto. In these collaborative projects, developing awareness and understanding of IPR plays an increasingly important part, for "the absence of patent protection does mean that some companies will not transfer certain technologies or certain crop applications" (Lewis 1999).

During the past few years, African countries have emerged as the frontier for biotechnology transfer in a new sense, especially in the light of the political turmoil over the recent food crisis in Southern African countries and their rejection of GM food aid from the US (Hisano 2004; Masood 2003). For example, ABSP has launched the Southern Africa Regional Biosafety Programme in 2000 to provide technical training in biosafety regulatory

implementation. Moreover, a new programme called the Program for Biosafety Systems (PBS) was announced in May 2003 to award $14.8 million to assist developing countries, including East, West and Southern African countries, to enhance and assist governments' biosafety policy, research and capacity (ISNAR 2003). However, it is cautiously anticipated that every attempt of this kind will be made to ensure that biosafety regulations are consistent with the US interpretation of the WTO rules rather than the Biosafety Protocol (The Third World Resurgence Issues 2004). The same concern is also expressed in a *Nature*'s article as follows: "The US and its private sector allies would like the laws in African countries to reflect their own views – that GM technology is inherently safe unless proven otherwise, and that countries should not be allowed to refuse GM imports just because they don't particularly want to eat GM food. There are strong reasons to think that the USAID grant will be used to support this position" (Masood 2003).

Another example of USAID brokering activities is the African Agricultural Technology Foundation (AATF), which was established in July 2002 in cooperation with Rockefeller Foundation, UK Department for International Development (DfID), and biotech companies (Monsanto, DuPont, Dow AgroSciences and Syngenta). Although its website reads that it will link "the needs of resource-poor farmers with potential technological solutions" (AATF website, accessed in August 2004), it is also mentioned that: "the goal of the AATF will be to work… to negotiate the sales rights of genetically modified crops and bring new agricultural technologies to the African market" (Oryza.com 2004).

Bt cotton as a Trojan Horse?

It is clear from the above examples, that the conventional model of public-private partnerships implemented within the CGIAR centres and/or brokered by the ISAAA and the USAID has prioritised the transfer and dissemination of proprietary biotechnology applications: in many cases, GM technology and crops already tested or even commercialised in developed countries. Arguably Bt cotton is the only GM crop that is now commercialised in developing countries. Indeed, Bt cotton in South Africa has been heralded as an African success story by the biotech industry. While a well-cited study, focussing on the agricultural economics of Bt cotton based on premature data in 1998/99, had proclaimed huge yield increases for Bt cotton farmers of the Makhathini Flats, in northern KwaZulu Natal, South Africa (Thirtle et al. 2003), it is now widely recognised that Bt cotton has not proved to be sustainable in terms of reducing pesticide use nor in terms of improving income for farmers (Pschorn-Strauss 2005).

Furthermore, the hype of Bt cotton in India has been also watered down by a three-year field assessment in the villages of Andhra Pradesh as well as sporadic reports from other states. The study conducted in Andhra Pradesh found that Bt cotton have largely failed so that farmers had to spend more (no reduction in pesticide use; three to four times expensive seeds; 12 percent more cultivation costs in total) which also suffered lower yields (30 percent less than non-Bt cotton) (Qayum & Sakkhari 2005). Such outcomes were more or less expected from the outset, since it is quite logical that increasing reliance on a single gene in growing a variety of crops to make them resistant to certain insects could not be sustainable. Also, especially in developing countries small farmers have long been squeezed between rising input costs and stagnant or declining producer prices. They are suffering a continued

reduction in domestic support under the growing pressure of IMF/World Bank structural adjustment policies as well as multilateral (WTO) and bilateral agreements, while massive subsidies in the US and the EU allow their large-scale producers and agribusinesses to enjoy competitive advantages in the export market (Greenberg 2004).

Pschorn-Strauss sees Bt cotton introduced in developing countries as a Trojan Horse: "By having one GM crop in place, it is then possible and far easier to grow other GM crops; the necessary legislation is in place, the relevant scientists are trained up, the idea of genetically modified crops is more acceptable, etc… Bt cotton has been chosen as a Trojan Horse in Africa and India, as it is perceived as being less controversial (it is not a food crop) and it has been easy to convince farmers with little money to start growing it" (Pschorn-Strauss 2005:14-15).

Problems with conventional public-private partnership model

Sticking to this kind of technology transfer model is apt to divert our attention from serious and reflexive discussions as to what types of technologies should and can be applied in what way and in whose hands.

First, it is rightly claimed that modern biotechnology is not "the" option (or "silver-bullet"), but an option to complement conventional and traditional technologies/knowledge as well as socio-economic interventions. However, as far as technology transfer projects promoted by the mainstreamers through public-private partnerships are concerned, the question of what kind of technologies is really demanded by resource-poor farmers to solve their problems is tacitly avoided. Technologies are always given there to be transferred and disseminated among developing countries from the beginning. Unfortunately, this is also true of the FAO report: despite that the report starts off about the versatile character and various forms of biotechnology (FAO 2004: chapter 2), FAO's political implications are largely coloured by the idea that GM technology is "the" option. As Tripp (2002) clearly points out, no matter what its eventual contribution might be, GM technology is not the only thing standing between resource-poor farmers and secure livelihoods. "Not only is there a need for complimentary technology, there is also a need to strengthen the institutions that support agriculture" (Ibid.: 241).

Second, while the transfer of proprietary technologies and materials on the top-down basis has been prioritised in the name of "humanitarian aids," other approaches and programmes on the participatory, bottom-up basis, such as the Interactive Bottom-Up Approach (IBU) that involve local stakeholders in decision-making on the technology (Ulmanen 2003), have rarely drawn mainstreamers' attention. What should have been done instead is to draw our attention to other feasible solutions such as tissue-culture and molecular-marker assisted technologies, and to emerging approaches to "the innovative and participatory efforts of various civil society organisations to establish new co-creative relations between biotechnological and endogenous developments to reach those people that have been bypassed by the industrialisation of agriculture and green revolution" (Ruivenkamp 2003b).

Third, contents and directions of the capacity-building needed to promote "biotechnology for the poor" are also open to question. Based on above two observations, we can justifiably assume that capacities recommended to be built up in developing countries include those to ensure, or at least stimulate, the interactive and participatory processes to reflect local needs and knowledge, aiming eventually to empower these local stakeholders. However, the FAO report, for example, induces developing countries to "strategically evaluate their research capacity and

focus their efforts on ensuring at least a minimum capacity to evaluate biotechnologies and adapt imported technologies" (FAO 2004: 92). The report might be right when it says that every developing country doesn't need to attain advanced research capacity. But, the report is going on to recommend developing countries to build up a certain set of capacities such as "more efficient biosafety regulations and stronger IPRs," which are seen as indispensable to stimulate private companies' incentives to transfer their proprietary technologies. It can be easily imagined that this recommendation would just satisfy the mainstreamers who have always tried to manipulate international regulatory frameworks to this end.

Lastly, it is commonly assumed that if the technology will be put under the management of public research institutions such as the CGIAR centres, it must be useful and feasible to resource-poor farmers. What comes into question is the degree to which these public institutions can keep their mandate as a generator and protector of public-good science and technology. Although most literature concerning the possibility and necessity of public-private partnerships in biotechnology R&D also acknowledge the managerial difficulty of and constrains on actual collaboration (Spielman and van Grebmer 2004; Rausser et al. 2000), the above question is hardly asked nor answered. As a matter of fact, there have been a lot of criticisms against the CGIAR for having changed its mandate from being a publicly funded research body working with civil society to alleviate poverty and hunger, to "an agricultural research outsource for the multinational corporations" (Sharma 2004). What should be called to mind in this regard is the following fact. During the period from the late 1990s till 2002, the NGOC as a representative of civil society organisations (CSOs) was struggling to seek the possibility of creating constructive, rather than antagonistic, relations with the CGIAR (Waters-Bayer 2001), by regarding it as "a good and useful Work Horse – part of a team of horses clearing the way for food security around the world" rather than as "a Trojan Horse for trade representatives" or "a War Horse advocating CSO policies" according to RAFI's expression (RAFI 2000). All the effort of the NGOC to make the CGIAR to reflect diverse civil-society voices seriously, however, have turned out to be in vain, as had happened to the system review process in 1998. The NGOC then has decided to disengage itself from the CGIAR (Kapiriri 2003). As such, its mandate to work with broad stakeholders to produce public goods for the benefit of the poor in developing countries and to safeguard the genetic resources taken from farmers' fields and held in public trust by the CGIAR genebanks is at stake (Sharma 2004). There is also a sceptical remark that even without being approached by industry, the pressure to be associated with particular developments in industrialised agriculture is so strong that public research institutions carry out the same sort of research as private institutions (Ruivenkamp 2003c). On this ground, there is no reason to expect the CGIAR centres and their national counterparts to serve the public interests without any condition.

4. Room for manoeuvre to counter hegemony

It is argued that scientific knowledge, technologies, and technological practices are built in a process of social construction, negotiations and decisions, rather than driven by any internal technological logic (Bijker and Law 1992). While based on this line of thoughts (i.e. social constructivism), however, Feenberg (1999) does not just analyse the socially contingent nature of technological design. He instead focuses on the unequal distribution of

influence over technological design. The design of a given technology is not just shaped by social actors enrolled in a socio-technical network, but structured by a certain institutional arrangement in which not all actors have the same amount of influence in the process. The technology and its design reflect the hegemonic beliefs, values and norms of the dominant group. To this effect, he employs a concept of "cultural horizon" to describe how the technology is designed and accepted in the way that incorporated beliefs, values and norms appear natural, general and unquestioned to those dominated (Feenberg 1999).

Gramsci (1971) argues that hegemony is where a politically dominant class maintains its position not simply by force, or the threat of force, but also by an ideology to win a sort of consent among various social groups, not least subordinate classes, to the social order maintained under the intellectual and moral leadership of the dominant class. Hegemony as such is produced and reproduced through a network of institutions, social relations, and ideas outside the direct political sphere ("civil society"). This nature of hegemony makes the social meaning (cultural horizon) behind a certain technology invisible once it is translated into technical terms. This explains why a re-contextualising critique of technology is required to uncover that horizon, demystify the illusion of technical necessity, and expose the relativity of the prevailing technical choices, and why this critique has to be carried out with a sense of political economic context in which the development of technology is inextricably linked to the hegemony of the dominant class in society.

> *The narrow focus of modern technology meets the needs of a particular hegemony… Under that hegemony technological design is unusually de-contextualised and destructive. It is this hegemony that is called to account, not technology per se, when we point out that today technical means form an increasingly threatening life-environment. It is this hegemony, as it has embodied itself in technology, that must be challenged in the struggle for technological reform. (Feenberg 1995: 17)*

Coming back to the mainstreamers' discourse of "biotechnology for the poor", we can identify multilayered hegemonic strategies for legitimising their interests on certain developments of biotechnology at the cost of alternative perspectives for biotechnology developments.

Hegemonic strategies by political force or threat of force

A typical example is found in the case that in May 2003 the US government and its allies decided to file a case with WTO against the EU over its so-called "a de-facto moratorium" on approving new GMOs imposed in 1998. Although this WTO case has an aspect of trans-Atlantic trade war as has happened in various agricultural products, there are also other important implications about the appropriateness of safety regulations as well as the discourse of "biotechnology for the poor." The latter issue has erupted when the US president George W. Bush said that: "For the sake of a continent [Africa] threatened by famine, I urge the European governments to end their opposition to biotechnology. Acting on unfounded, unscientific fears, many European governments have blocked the import of all new biotech crops. Because of these artificial obstacles, many African nations avoid investing in biotechnology, worried that their products will be shut out of important European markets" (cited from news release from the White House). This political threat was very crucial at that time because some Southern African countries were suffering from food crisis since the previous year and driven to accept emergency food aid. The Bush's statement above was

made when those African countries declared not to accept food aid from the US as it might cause GMO contamination. Under overwhelming pressure to accept GM food aid, it was only Zambia that could hold out to the end and finally overcome its food crisis without GM food aid. When Angola and Sudan faced food crisis in early 2004 and requested that food aid be certified “GM free” or at least “milled”, they were strongly criticised by the US government, and since then constant pressure has been applied in both countries (African Center for Biosafety 2004).

Hegemonic strategies through forming institutional networks and social relations

As already analysed before, establishment of public-private partnerships intermediated by ISAAA and USAID fit into this category. Philanthropic activities of the mainstreamers such as the Monsanto Pledge and the Syngenta Foundation are also effective to manoeuvre for their hidden agenda. In some cases, these institutional networks are also brokered by mainstreamers’ regional lobbying groups, such as AfricaBio, to approach scientists and administrators in developing countries.

Hegemonic strategies by use of intellectual and educational tools

To effectively implement above strategies, the mainstreamers have launched tactical and massive public-relation campaigns through their lobby groups disguised as neutral third parties. These campaigns are targeted at epistemic communities (ILSI: the International Life Science Institute, the AgBioWorld Foundation, IFIC: the International Food Information Council); journalists (IFIC, CBI: the Council for Biotechnology Information); school teachers and young students (CBI, the Biotechnology Institute) as well as direct stakeholders like consumers and farmers. Since January 2000 the AgBioWorld has collected endorsements from more than 3,400 international scientists who have signed its “Declaration of Support for Agricultural Biotechnology to improve agriculture in the developing world”. Its website proudly says that signers include 25 Nobel Prize winners and other prestigious scientists. The Biotechnology Institute has made a strong effort to reach school teachers through professional development and support materials, linking and supporting local, grassroots teacher programs, and so on. This institute is also organising activities, meetings and conference to educate international audiences. Both of the IFIC and the CBI provide their target groups with a lot of publications and information kits as well as professional newsletters. Not surprisingly, these “non-profit” organisations are funded by and hand-in-hand with agro-food and biotechnology industries.

All of these hegemonic strategies are usually complimented by lobbying activities organised by the business sector such as BIO (Biotechnology Industry Organization, USA), GMA (Grocery Manufactures of America, USA), EuropaBio (European Association for Bioindustries, EU), BIAC (Business and Industry Advisory Committee to the OECD), CropLife International (former Global Crop Protection Federation), and ICC (International Chamber of Commerce)’s Commission on Biosociety.

Counter-hegemonic movements with the pro-contra debate being intensified

Faced with these overwhelming hegemonic strategies implemented by the mainstreamers, many civil society

organisations as well as individual critics have been waging a frontal and outright attack on the hegemony, creating and intensifying the pro-contra debate. Indeed, we have witnessed the occurrence of massive social changes: solidarised demonstrations against the globalisation project (McMichael 2000) at the WTO Seattle meeting in 1999 as well as subsequent meetings in Genoa, Doha and Cancun; a networking of international civil society movements such as the World Social Forum in Porto Alegre and Mumbai. Biotechnology issues have been counted as a core part of these counter-movements against the globalisation project (Buttel 2003). Also, there have been a lot of "voices from the South" raised to counter mainstreamers' PR-campaigns and reveal the falseness of their discourse of "biotechnology for the poor" (Hickey and Mittal ed. 2003). Finally, we cannot disregard the escalation of biotechnology politics into international political arenas, like the passage of the Cartagena Protocol on Biosafety in 2000 (come into effect in 2003) despite the tremendous influence of the Miami Group and the industry. As far as these struggles can stimulate our concerns about the technology and our awareness of the falseness of the discourse, we still need such counter-hegemony movements.

However, as mentioned above, the more sceptical and critical public opinions about the technology become, the more deliberate strategies the mainstreamers work out to countervail scepticism and criticism. It is also probable that, the more intense and antagonistic the pro-contra debate over the technology become, even those researchers and administrators who rightly get insight into the social significance of their work through the politicisation of biotechnology, can find less and less chance and space to set their reflection into action. If this is the case, they are likely taken in the side of the mainstreamers who advocate the rationality and soundness of modern science and technology. Or else, it is likely suggested to deconstruct agricultural research, by challenging "positivist and realist epistemologies" of scientific knowledge – then to reconstruct it elsewhere "along different lines for genuine approaches" towards sustainable agriculture (Kloppenburg 1991; Kloppenburg and Burrows 2001)[5], rather than to look for the room for manoeuvre to democratise the scientific knowledge and technology design processes from within. Although it is completely right when one says that farmers' local knowledge should be taken into account seriously as an alternative source of knowledge production for agriculture, we need some reservations with regard to the scepticism about a possibility of scientific knowledge and technologies to be tailored and used to facilitate sustainable and endogenous developments of agriculture.

Counter-hegemonic tactics from within to democratise technology

As Feenberg (1999) has proposed, we need to conceptualise technology as an ambivalent process, and consequently, as a site of political struggle. Ambivalence means the availability of technology for alternative development in different social contexts with different social consequences, but not in a sense of contingency as already criticised above. Schurman (2003) shares this positive perspective of technology development based on her insight into the ambivalence.

Many of the technological, social, and institutional development are fundamentally ambiguous. Technologies embody

[5] His discussion is criticised by the following papers: Molnar et al. (1992) and Sellamna (1999). Kloppenburg replies to Molnar et al. (1992) in his another paper (Kloppenburg 1992), according to which, he clearly denies a "wholesale invalidation of science".

> *emancipatory, as well as oppressive potential, depending on how that technology is deployed, by whom and for what purposes and on the meanings it is given by those who use it. It is not hard to imagine liberatory and positive possibilities, as well as the more negative scenarios. (Schurman 2003: 19)*

At stake therefore is how to democratise the technology and bring out its emancipatory and positive possibilities: not just through its applications but its very design to meet the social demands of disadvantaged majorities. As already experienced in the slow but steady progress of international regulatory frameworks, we still need political struggles over institutional reform, since the very process of political struggles can "create opportunities for altering power dynamics and relations in the future through the re-evaluation of existing patterns and the establishment of new norms, regulatory frameworks, and institutional relationships" (Schurman 2003: 18-19).

At the same time, the nature of hegemonic strategy should be taken into account to come up with a proper perspective for democratisation of technology. According to Gramsci, hegemonic influence is exercised effectively through ideological social institutions (i.e. intellectual and moral leadership). Under such hegemony, the process of social transformation must entail wide-ranging counter-hegemonic cultural activity, rather than (or, at least before) confronting head-on the hegemonic social structure. The former strategy is referred to as a "war of position", in which we need to engage with the logic of the system, or to be "tactically inside and strategically outside the system" (Paulo Freire, cited in Mayo 1999: 6). This is mainly because it would be effective, however long it takes, to gain influence in the cultural institutions of "civil society", to develop organisational capacity, and to win new allies to transform the system in the end. Certain ideas or ideological statements are turned into facts not only by the power of discourse, but also by gaining control over the social support networks and the material resources of organisations and networks (Bieler 2001). As far as the social support networks and material resources are under hegemonic control of the mainstreamers, we have to engage in a "war of position" to regain control over the social support networks and material resources in a tactical way.

This idea is compatible with Feenberg's concept of "democratic rationalisations". He has got hints from De Certeau's discussion of strategies – institutionalised means of control embodied in social and technological systems – and tactics – responses of the dominated to the dominant codes from within – (Feenberg 1999). When the dominated cannot escape strategies, only by tactically reacting to the strategies the dominated can find a "margin of manoeuvre" to misappropriate resources, manipulate the rule, weaken the control of the dominant and alter the framework in the end. Such tactics are possible because what we call the system, or hegemonic social structure, is actually complex and divergent sets of social relations and therefore is fragile and vulnerable to tactical subversion. The concept of "democratic rationalisation" is derived from his conviction that new technology can also be used to undermine the existing social hierarchy or to force it to meet needs it has ignored. In this relation, he sheds light on user interventions to challenge undemocratic power structures around technology and its design. Such interventions are carried out in different ways, such as (i) public controversies and other challenges mounted by lay actors to force design changes; (ii) "innovative dialogue" and "participatory design" through which expert and lay actors may collaborate in creating a technology; (iii) the process of "creative appropriation" in which users

innovate new functionalities for already existing technologies, as seen in the internet (Ibid.). All of these must be incorporated in the idea of TMBT-like counter-hegemonic projects, while the last one is supposedly relevant to a possibility to re-appropriate elements of biotechnologies and redesign them to serve resource poor farmers.

Transformative education to counter hegemony

We need to focus on the role of professionals, scientists, intellectuals or whatever we call them, in the process of social transformation to challenge the technological hegemony. Gramsci defines “organic intellectuals” as a thinking-section of the particular social class to direct and organise its elements (Gramsci 1971). Aiming for hegemony, those organic intellectuals need to convince “traditional intellectuals”, whose role is to produce consensus in civil society.

This focus on the role of intellectuals doesn’t mean that the role of lay actors is disregarded in the process. According to Gramsci, hegemony necessarily always involves an educational relationship; whereby institutions operating within “civil society” and those agents (traditional intellectuals) associated with them tend to endorse the ideology of the dominant. When Gramsci regards forms of adult education, in distinction from formal education, have an important role to play in a ‘war of position’, he implies the dual process of education; self-education and social education, in the course of counter-hegemonic projects (Suzuki 1999). The attention to the former is based on his understanding of the process of empowerment, in which an individual becomes a transformative actor by embodying critical reflection and self-awareness in social, political and economic context of the capitalist society. This insight into the “substance” concept of human nature characterised by conscious and cooperative activity is derived from the Marx’s theory of alienation; whereby it can be understood that he/she faces a constant contradiction between hegemonic ideology and his/her social experience (or practice) as the subordinate that in turn makes this interface into an inevitable site of ideological struggle. A well-referred concept of human “essence” as the ensemble of social relations should be regarded as the second layer, which can only be attached on the fundamental and substance human nature as a conscious being: otherwise we cannot understand how he/she is being empowered and identified to be a transformative being through consciously changing him-/herself as well as social relations. This dialectical synthesis of “substance” and “essence” of human nature into a transformative actor with critical self-reflection is what can be described as the process of empowerment.

What social education and those agents (organic intellectuals) associated with it can do for this process is to intermediate and help this self-education proceed effectively. Insofar as those subordinated find themselves in difficulties to develop views that challenge hegemonic ideas and practices and to unveil the underlying contradictions within the dominant ideology, the role of organic intellectuals is essential. However, this process of self- and social education must be reciprocal, since organic intellectuals and social educators also need their own self-reflection in social, political and economic context. What is more important is the dialectical relation between intellectuals who “know” and the “people-nation” that “feels” (Gramsci 1971). The former may know but do not always understand or feel, while the latter may feel but does not always know. Intellectuals, in order to know something socially and politically, not merely abstractly or philosophically, must understand it with feeling and passion.

> *One cannot make politics-history without this passion, without this sentimental connection between intellectuals and people-nation. In absence of such a nexus the relations between the intellectual and the people-nation are, or are reduced to, relationships of a purely bureaucratic and formal order; the intellectuals become a caste, or a priesthood. (Gramsci 1971: 418)*

In my view, such a nexus is one of those provided in the TMBT-like counter-hegemonic projects. If demands and alternative knowledge of lay public need to be translated and incorporated into technical codes to gain a broader consensus, it is only by interacting with those dispossessed public that scientific researchers as "organic intellectuals" are expected to contribute. It is therefore crucial to ask whether and how reflexive activities of scientific researchers, whose contributions are also expected in the regulatory and administrative processes[6], can be stimulated through involvement in counter-hegemonic projects.

5. Conclusion

The aim of such counter-hegemonic projects is not just to criticise and reveal the falseness of the discourse, while such a social critique to expose the contradictions that lie behind the dominant hegemonic discourse remains crucial. What we need further is to develop a discursive as well as institutional setting for reflexive researchers to gain moral and intellectual control over the social support networks and material resources for the alternative purposes, while effectively and persuasively politicising the hegemonic model of biotechnology development described in the mainstream discourse. This is by no means easy task. However, it should be reminded that the mainstream discourse of "for the poor" and/or "for the environment" (albeit for their own interest) cannot but open up the room for critical reflections among those involved. By demonstrating affluent possibilities, and partly emerging examples, of alternative biotechnologies to meet the needs of the resource poor and by connecting organic intellectuals (transformative scientists and administrators) to the dispossessed, or, in other words, playing a nexus, TMBT-like counter-hegemonic projects are expected to give the room for critical reflection among those intellectuals.

> *They [Researchers] can attempt to grasp again the social significance of their scientific sub-sector. Or the social contrast in the research can eventually stimulate the researchers to 'sub-politicisation' of the research to an attempt to actually get insight into the social significance to their work. (Ruivenkamp 2003c: 36)*

[6] Their role is especially important when the tactical efforts of counter-hegemonic projects are made to influence global law and policy, about which social scientists as well as lawyers can play a significant role (Rajagopal 2003).

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